American Association of State Highway and Transportation Officials
Special Committee on Research and Innovation

FY2021 NCHRP PROBLEM STATEMENT

1.   Problem Title
What do state and local transportation agencies need to capitalize on the impending flood of connected vehicle data?

2.   Background
State and local transportation agencies expend considerable resources collecting traffic data for a multitude of reasons. They range from compliance with Federal programs like the Highway Performance Monitoring System (HPMS) to roadway design and managing traffic operations in real-time. As a benchmark, the New York State DOT estimates that their statewide average cost per count is $200. They conduct approximately 12,000 short duration counts per year[1]. This means the NYSDOT spends an average of $2.4 million every year just on short duration counts. This does not include the maintenance costs of counting equipment. In 2013, New York State had almost 115,000 miles of the 4.1 million miles of total public roadway miles maintained nationwide.[2] Even if the average cost per count was $150 nationwide, and assuming other states DOTs have a similar count rate to NYSDOT, this would be almost $65 million spent nationwide each year on short duration counts. The total could exceed $100 million annually if the costs of the NYDOT counts per mile are less than average. For example, North Carolina DOT has over 106,000 miles to maintain but spends approximately $6 million per year alone on their traditional traffic monitoring program, which does not include over $1 million spent on probe data in the state.[3]

Connected vehicles that broadcast their movement and characteristics several times per second are already on the roads with the number to increase exponentially in the next few years. They represent a rich source of data that will be available, with the potential to complement or supplant the existing sources of data that transportation agencies use. Moreover, new data elements and the massive scale, eventually over 200 million vehicles, have the potential to provide agencies entirely new capabilities, as well as performing existing tasks better and more efficiently. Transportation agencies may miss this opportunity unless two specific gaps in knowledge are crossed. The first is, what requirements state and local transportation agencies have that should be written into the SAE and IEEE standards for connected vehicle data to make this data more valuable and easier for transportation agencies to use? What research should the USDOT support? The current standards were originally developed with crash avoidance safety applications in mind, without consideration of traffic monitoring and operations.

The second is, what must state and local transportation agencies do to prepare in order to be able to capitalize on this data source? The research identified in the NCHRP 20-24(98) Draft Connected/Automated Vehicle Research Roadmap for AASHTO[4] needs to be turned into actionable requirements for state and local transportation agencies that lack the personnel budgets to cross that gap on their own. Adding personnel with new skills to deal with this new wireless and data intensive technology is obvious, but other technical, institutional, legal, policy and operational requirements may not be. Without proactive consideration of these two questions, this opportunity and the resulting

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[1] https://safety.fhwa.dot.gov/rsdp/downloads/fhwasa17034.pdf; accessed October 17, 2018
[2] https://www.bts.gov/content/public-road-length-miles-ownership; accessed October 19, 2018.
[3] Communication from NCDOT, October 19, 2018.
[4] http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-24(98)_RoadmapTopics_Final.pdf; accessed August 17, 2017

benefits may be lost or at least delayed many years. A national study may also prevent the few states that are deeply involved from coming up with differing and incompatible solutions that would slow down future efforts to standardize and implement the technologies and processes to all states.

AASHTO's Committee on Transportation System Operations (CTSO) currently provides guidance on CAV integration, per its website, and its Working Group on CAVs, as well as its Subcommittee on Performance Management and Data, are looking into a slew of CAV-related topics, including asset management of CAV related assets and data/performance management needs. This RNS aligns closely with those focus areas and would prevent falling further behind on CAV data management, as CAVs become increasingly more popular and available to the general public.

3.   Literature Search Summary

The automotive industry has focused on V2V safety applications, while the USDOT has pushed research for V2I. Most of it is focused on safety applications. The research described in a recent research circular[5] shows some Federal activities branching out into other kinds of mobility management messages. This research would be a good starting point to compare the direction of existing V2I research with the needs of agencies responsible for traffic monitoring and traffic operations. The NCHRP 20-24(98) Draft Connected/Automated Vehicle Research Roadmap for AASHTO took a high-level first step. This research is a next step focused more specifically on what state and local transportation agencies need and can do to capitalize on the data that will be presented to them once CV data becomes the resource it is expected to be. These activities could include server and cloud integration with the existing infrastructure, network improvements, among other action items.

4.   Research Objective

The primary objectives of this research are:

- Create a set of technical requirements for connected vehicle data transmitted from vehicles to propose to the SAE and IEEE standards committees and the USDOT that would significantly aid state and local transportation agencies in using connected vehicle data for traffic monitoring and traffic operations.
- Develop a checklist of actions that state and local transportation agencies must take in order to be able capitalize on the available connected vehicle data. This checklist may be organized by "essential," "strongly recommended," and "desired" or a similar categorization, as not all states will approach connected vehicle data with the same resources.

Certain tasks should be included in this research. Without prescribing how to do the research, it needs to include an activity that engages state and local transportation agencies to determine their requirements for connected vehicle data if applied to traffic monitoring and counting applications, and to compare with what is already provided by that data.

The tasks to determine what agencies must do to exploit connected vehicle data must include a look at the certifications and requirements to participate in the connected vehicle ecosystem. They might include security and privacy requirements and how best to collect the data.

5.   Urgency and Potential Benefits

Benefits fall into three basic categories, with the first being the economic savings of supplanting existing sources of traffic data, which require constant maintenance and management, discussed previously in

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[5] Advancing Highway Traffic Monitoring Through Strategic Research, Transportation Research Circular, No. E-C227, December 2017, pages 80-87.

the Background section. Second is the operational efficiencies of having data that is higher resolution in space and time, while providing greater areal coverage. The NYSDOT aims for ten percent of coverage in its 1,500 municipalities each year[6], which does not include rural areas. With connected vehicles expected to increase by 270% over the next four years[7], the rate of connected vehicles could easily surpass 10% in the next decade. A penetration rate that high could easily provide data from far more than 10% of the roadway miles. Third would be the potential new capabilities provided by the new data elements and characteristics of this widespread but highly granular data. As was true of the internet, the most important developments were not envisioned at the outset, and the financial benefits couldn't be accurately quantified.

6.   Implementation Considerations and Supporters
A follow-on to this research would be a pilot program that tests the preparation checklists during the real collection of connected vehicle data and its use for traffic monitoring and traffic operations.

The AASHTO Committee on Transportation System Operations, specifically the Working Group on CAVs and the Subcommittee on Performance Management and Data, would greatly benefit from this research as it will provide guidance to these groups on how to best utilize the wealth of data sure to follow further development of CAVs and CAV-related technologies. The TRB Committees on Highway Traffic Monitoring and Vehicle-Highway Automation would also be interested in the results of this research.

7.   Recommended Research Funding and Research Period
$200,000 over 18 months.

8.   Problem Statement Author(s)
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9.   Others Supporting the Problem Statement
● TRB ABJ35 Highway Traffic Monitoring Committee

10.   Potential Panel Members
● Not available.

11.   Person Submitting the Problem Statement
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[6] https://safety.fhwa.dot.gov/rsdp/downloads/fhwasa17034.pdf; accessed October 17, 2018.

[7] https://www.counterpointresearch.com/125-million-connected-cars-shipments-2022-5g-cars-2020/; accessed October 19, 2018.